Tailoring Gamification to Requirements Elicitation: A Stakeholder-Centric Motivation Concept

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Tailoring Gamification to Requirements Elicitation: A Stakeholder Centric Motivation Concept

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***Abstract*—Involving stakeholders in requirements elicitation is a cornerstone of successful requirements engineering (RE). With the recent technological advances, the number of stakeholders of a system has significantly increased. Major stakeholders, end-users in particular, are increasingly difficult to reach, because they may be globally distributed and outside organizational reach, i.e., they are no members of the organizations that are involved in the development of a system. Online elicitation platforms allow to elicit requirements collaboratively from a large number of distributed stakeholders. However, such platforms are not sufficient for motivating stakeholders outside organizational reach to contribute voluntarily. Gamification is a potential means for creating and sustaining such motivation. However, there is little research on stakeholder engagement with gamification so far. Current approaches particularly do not consider that stakeholders learn during elicitation and that their motivational factors also change.**

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***Index Terms*—requirements elicitation, player types, skill acquisition, experiential learning, gamification, self-determination**

I. Introduction

Successfully developing and evolving software systems requires involving the stakeholders in requirements elicitation. In the past, the number of stakeholders of a system was typically rather small. Most of them were directly accessible as members of the client's or the supplier's organizations. With the recent pervasiveness of systems and applications, the number of stakeholders of a system has drastically increased. For many systems, more or less everyone is a potential stakeholder [1]. Moreover, stakeholders, in particular end-users, of novel software products are often outside organizational reach, i.e., they cannot be identified among the members of the involved organizations. Typical examples include stakeholders of software systems for the sharing economy, the quantified self, and mobile applications. Established elicitation methods are not sufficient to elicit requirements from these stakeholders. In particular, they rarely scale (e.g., interviews, workshops) or hinder successful communication (e.g., polls, online questionnaires) [2].

Lately, RE researchers have addressed these challenges with online elicitation platforms, e.g., wikis [3] and social media platforms, e.g., Liquid RE [4] or REfine [5]. However, while these platforms enable the collaborative involvement of large numbers of stakeholders, this is not sufficient to motivate the stakeholders to use these platforms actively and contribute to requirements elicitation. In particular, in order to receive substantial contributions from stakeholders outside organizational reach, an explicit motivation concept is required. In our work, we are developing such a concept based on gamification.

Gamification, the use of game (design) elements in non-game contexts [6], has successfully been applied in different domains to motivate users towards desired activities, e.g. [7]. Recently, first approaches of applying gamification to motivate stakeholders *within* organizational reach towards contributing to requirements elicitation, e.g., [5], [8], [9] indicate that RE can benefit from gamification.

However, research in this field is in its infancy. This may severely challenge the success of software systems: when failing to engage the consumers, technological trends might be overseen, valuable knowledge missed and end-users, customers, and clients lost [10]. We argue that, in particular, more research is needed on how to motivate stakeholders *outside* organizational reach towards requirements elicitation.

In the scope of our research project Garuso (**G**ame-b**a**sed **R**eq**u**irement**s** Elicitati**o**n) [11], we address this gap with a motivation concept that follows the theories of experiential learning and need satisfaction and is tailored to a social media platform that combines a forum for contributing, discussing and rating needs with gamification.

In this paper, we describe the three dimensions of this concept and show how it is applied. Our work contributes to the emerging research field of involving globally dispersed groups of stakeholders in requirements elicitation.

II. Related Work and Background

In this section, we introduce gamification and the motivation theories relevant to our work. The context of our work is illustrated in Fig. 1.

A. Gamification Primer Through the Lens of RE

The goal of applying gamification is to motivate users with game elements towards a desired activity, i.e., increasing the quality or the quantity of a product [12]. Table I gives an

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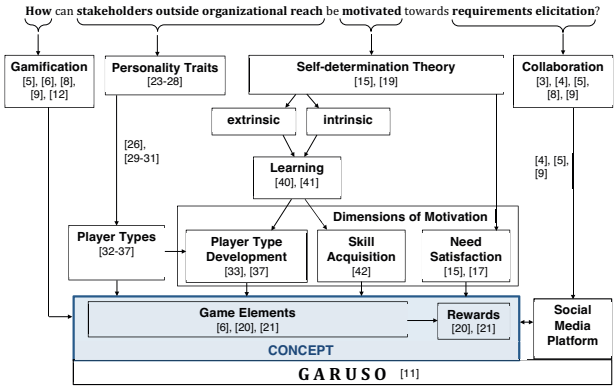

Fig. 1. Context of our Work with relevant references.

overview of common and popular game elements and the rewards they represent. In software development, one of the biggest success stories of gamification is Stack Overflow [7], an online platform that motivates users with levels and badges towards global, collaborative issue management. When writing this paper, Stack Overflow had over 6.5 million users.

RE researchers have developed first game-based tools and platforms for elicitating requirements. To improve participation in RE, iThink [8], a Web-based elicitation tool, combines gamification with parallel thinking [13]. To involve crowds of stakeholders in the context of software product organization, REfine [5], an interactive online platform for requirements elicitation and refinement, combines gamification with crowdsourcing [14]. For both approaches, the qualitative and quantitative evaluation of their case study results indicate that the stakeholders' contributions to requirements elicitation can be motivated with gamification. Further, results of a recent laboratory experiment with a game-based platform showed that applying gamification in the context of scenario-based RE leads to requirements of higher quality and more creativity [9]. However, all approaches involved stakeholders *within* organizational reach (iThink: a class of graduate students; REfine: developers, clients, and users; experiment: employees) and did not consider the evolution of the stakeholders' experience and motivation during the elicitation process.

B. A Nutshell of Motivation within Gamification

Being motivated means *"[..] to be moved to do something"* [15] (p.54). People who are motivated in an activity are more engaged in this activity. Whether and how motivation can be enhanced has therefore raised major interest. Over the last decades research in psychology have uncovered a whole spectrum of human motivation [16], e.g. [17], [18], [19].

Gamification mainly refers to Self-determination Theory (SDT), e.g., [19], which conceptualizes motivation with respect to its driving force as extrinsic or intrinsic. People are extrinsically motivated if they are driven by an *output which is separable from the activity itself*, i.e., any kind of reward (or punishment). On the other hand, people are intrinsically motivated if they engage in an activity due to an *inherent satisfaction* of doing so. Further, SDT considers motivation within a continuum of fluctuating intensity between the two extremes of no motivation (amotivation) and inherent motivation (intrinsic motivation), and four stages of extrinsic motivation between these extremes [15].

With respect to extrinsic motivation, a theory of motivating activities with rewards goes back to Skinner's behaviorist theory [18]. According to this theory, human behavior is conditioned and motivated with different reinforcements, i.e., rewards and punishments. With regard to the intensity of motivation, the theory of Maslow's Hierarchy of Needs [17] for example suggests that how much someone is motivated in something is influenced by how well human needs are satisfied. SDT considers three human needs as basic: *autonomy*, i.e., the feelings of being in charge, e.g., by having the power of free choice; *competence*, i.e., the feeling of having the ability to deal with a challenge; and *relatedness*, i.e., the feeling of being connected with others. According to SDT, the more a person perceives these human needs as satisfied when being rewarded (extrinsic motivation) or while performing an activity (intrinsic motivation), the more the person's motivation shifts towards or increases intrinsic motivation. In contrast, the risk of eliminating this person's prior (intrinsic) motivation towards an activity increases the more this person perceives a lack of need satisfaction, e.g., when being controlled by the rewards [15]. This effect is known as overjustification, a theory tested by Lepper et. al. [22].

C. Personality Traits

How people act is generally assumed to be influenced by their personality [23]. Personality traits are "latent characteristics of persons that determine the way in which individuals respond to the social world they encounter" [24] (p. 119), and their notion goes back to Aristotle [23]. Compared to personality types, personality traits are less rigid. While people

TABLE I
POPULAR GAME ELEMENTS USED IN GAMIFICATION [6], [20], [21]

Game Element	Description
Points	They show user performance and are the most basic game element. Usually, they are earned in categories for actions taken and are used as a virtual currency, for direct feedback, to address the desire to collect, and as metric for other rewards.
Badges	They represent success and status. Thereby, they address different motivation mechanisms, e.g., the desire to collect, to achieve a goal (of earning a badge), and to get status (by having earned a badge).
Leaderboards	They represent success and status. Basically, they are a dynamic ranked list of users that shows the users' performance in a specific context.
Levels, Progress Bars	They represent status and access. Both show the progression towards a goal, but levels are also often used to give access to a distinct group of people or features.
Challenges, Quests, Missions	They represent success and trigger the urge of goal achievement by transparently showing the success of actions, e.g., earning a particular badge for gathering a specific number of points.
Limited Resources	They represent pressure by making the activities dependent on the availability of resources such as life points or time.

usually have one dominant personality trait, they incorporate other traits [25] of different intensities [26]. For example, a person is creative (personality type) and has strong happiness as well as average confidence (two personality traits). Results of personality research further indicate that personality traits exist across cultures, e.g., [27] and are even universal, e.g., [28]. In the context of this work, we do not go into the details of the different traits or models, but focus on the overall idea of personality traits instead.

D. Player Types: A New Stakeholder Typology

Player types are not a perfect match to personality traits, but a good enough one [29]. Several study results show a relationship between personality and player types, e.g., [30], [31] and it is assumed that player types and personality traits are essentially the same construct within different contexts [26]. One of the most popular player type models referred to in gamification [26], [25], which we also use in our work, is the one by Bartle [32], [33], [34]. He identified four main player types: Achiever, Socializer, Explorer, and Killer, while observing the behavior of players in Massively Multiplayer Online Role-Playing Games (MMORPGs). According to his observations, these player types are located within the dimensions of sociability (acting vs. interacting) and exploration (player-oriented vs. world-oriented) [32], [33]. *Achievers* act in the world and *Killers* on other players, while *Socializers* interact with players and *Explorers* with the world. Each of these player types has an *implicit sub-type* that takes actions automatically and without thinking and an *explicit sub-type* that takes them thoughtfully and with prior planning (cf. Fig. 2).

Recently, several player type models have evolved, e.g., [35], [36], [37] and revealed three presumably general aspects. 1) The key domains *Achievement, Exploration, Sociability, Domination, Immersion* exist among most player type models [38]. 2) At any point in time one player type is usually dominant but users are very likely to show tendencies of the other player types as well [39], [37]. 3) Player types evolve along different paths as they get to know and better understand the virtual environment [34] or system to which gamification is applied [37].

E. Experiential Learning, Player Type Development, and Skill Acquisition

Experiential learning theory is a holistic theory that considers learning as a continuous process of human adaptation to the social and physical environment [40]. In particular, it reflects the relationship between a person and the environment with the dual meaning of experience: the personal meaning as in 'experiencing joy and happiness', and the environmental meaning as in '20 years of experience in the job' (p. 35). Thereby, experiential learning happens within the two dimension of experimenting vs. observing and experiencing vs. conceptualizing [40].

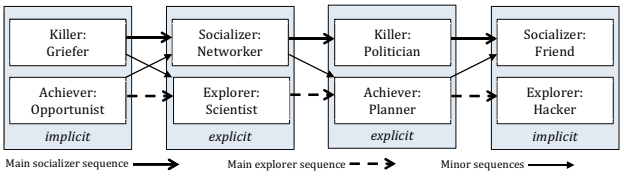

Fig. 2. Four main player types with their implicit and explicit sub-types and three development sequences (based on: [34]).

In the dimension of *experimenting vs. observing*, people learn while moving between acting and reflecting. Similarly, when entering a virtual environment, most players initially perform a path of behavioral learning, in which environmental stimuli cause human responses, followed by a path of cognitive learning, in which knowledge is acquired and manipulated [41]. Thereby, as illustrated in Fig. 2 the players initially aim at understanding the basic rules and boundaries of the environment by either pushing every possible action to be better than others (*Griefer*) or by trying to advance by taking any chance (*Opportunist*). After having acquired the basic knowledge they start to cognitively process information and constantly update existing knowledge according to new situations [41]. Therefore, they create new actions by trial and error (*Scientist*) or by asking others (*Networker*) to achieve success in regard to the system (*Planner*) or to others (*Politician*). Finally, they have mastered all tools within the environment and understand the co-players (*Friend*) or the system (*Hacker*).

In the dimension of *experiencing vs. conceptualizing*, people learn while moving between feeling and thinking. Similarly, when acquiring skills, e.g., [42] people follow the desire to acquire new abilities by solving challenges. Thereby, they normally pass five stages of skill acquisition; *novice*, *advanced beginner*, *competence*, *proficiency*, and *expertise*.

III. Moving Towards a Motivation Concept

We developed the motivation concept in the scope of the Garuso project [11]. In this section, we present our research goal, and describe the main steps of developing and applying the concept. All steps are summarized in Table II.

A. Goal and Research Question

Our goal within the Garuso research project is to investigate stakeholder engagement in RE. One of the research questions addressing this goal is: *How can stakeholders outside organizational reach be motivated towards requirements elicitation?*. The concept presented in this paper contributes to answering this research question.

B. Steps of Concept Creation and Application

In the following, we describe the development of the concept (steps one to five), and its application (steps six to eight).

1) Interdisciplinary Literature Review: The concept is based upon our previous research on gamification for collaborative platforms [43] and strengthened with findings presented in the related work and background section of this paper.

TABLE II
MAIN DEVELOPMENT STEPS OF CREATING AND APPLYING THE CONCEPT

Step	Step Description	Status
1	Interdisciplinary Literature Review	Done
2	Defining the System Boundaries	Done
3	Evaluating Methods of Stakeholder Attraction	Done
4	Conducting an Experiment	Done
5	Conceptualizing Findings	Done
6	Finalizing the Implementation	In progress
7	Running and Monitoring the Implementation	Planned
8	Evaluating the Results	Planned

2) Defining the System Boundaries: We defined the system boundaries based on the following three assumptions. First, most of the stakeholders, i.e., mostly end-users of the system of interest, are outside organizational reach. Second, the platform used by the stakeholders to contribute to the elicitation of requirements of a software system is a social media platform that enables its users to collaboratively post, comment, and rate needs. Third, the stakeholders are non-experts with respect to the domain of application, i.e., the elicitation platform and the community interacting on the platform.

3) Evaluating Methods of Stakeholder Attraction: One important question regarding the concept is how to attract the stakeholders. In the context of crowdsourcing, 'workers' are often 'hired' over paid platforms. A critical aspect of this practice is that particularly monetary rewards bear a high risk of undermining intrinsic motivation [15]. Another approach avoiding this risk is the use of online advertisements, e.g., Google AdWords [44]. We went one step further and additionally distributed picture-based advertisements (ads) that target player types [45] over social media. In total, we attracted almost 600 stakeholders outside organizational reach, worldwide. Further, based on previous research on stakeholder identification, e.g., [46] we will consider the technique of snowballing [47] on the implemented Garuso platform, i.e., already identified stakeholders can recommend other (potential) stakeholders over the platform.

4) Conducting an Experiment: We investigated the algorithms controlling single game elements in a field experiment with an implemented prototype of the Garuso platform[1].

5) to 8) - Conceptualizing to Evaluating: Based on the previous steps, we conceptualized our findings as presented in this paper (step 5). Currently, we finalize the Garuso platform based on this concept (step 6). Next, we will test the Garuso platform within a case study with stakeholders outside organizational reach. Thereby, we will monitor their interactions (step 7), and evaluate the results (step 8).

IV. CONCEPT-BASED MOTIVATION OF STAKEHOLDERS

In this section, we describe the concept we developed and support the description with Fig. 3. The concept follows the theory of experiential learning to consider that these stakeholders experience the elicitation process over time and thereby 1) learn with respect to the domain of application and 2) develop in terms of how they feel motivated. Along this experience, it introduces (potential) rewards and tailors them with respect to the theory of need satisfaction. It is designed to be applied on social media platforms.

A. Three Dimensions of Motivation

To consider learning and change of motivation, we follow the theory of experiential learning by applying skill acquisition levels in the dimension of experiencing vs. conceptualizing (y-axis in Fig. 3) and player type development steps in the dimension of experimenting vs. observing (x-axis in Fig. 3). During the elicitation process, the stakeholders, i.e., users of the platform, move along both dimensions. However, with respect to the context of requirements elicitation, we consider transitions between the levels of skill acquisition to influence the transitions between the steps of player type development. In other words, while the users become more experienced during the elicitation process, they learn with respect to the domain, i.e., move one level up, which affects how they feel motivated, i.e., they move one step to the right. Every *level N/step N* intersections represents one stage in which the users are motivated with (potential) rewards that consider these dimensions. To intensify the motivational effect of the rewards on the users, they are further tailored to basic human needs. Considering that some users might change their dominant player type slower compared to increasing their skills, the rewards are inherited from one level to the next levels.

1) The Dimension of Skill Acquisition: For every skill level we introduce (potential) rewards and inherit them for levels above level one, thereby, access to domain activities (DAs) is considered as a reward. Following the theory of skill acquisition, a domain is only understood by people when they have reached the third level (competent) [48]. Therefore, we enable the basic DAs such as posting, commenting, rating, and labeling needs, e.g., categorizing them in functional or non-functional, in the first three levels. The rules that define when users move from one level to the next are created by the requirements engineer.

2) The Dimension of Player Type Development: We consider the potentially high heterogeneity of stakeholders outside organizational reach by applying the two main, i.e., most common, player type development sequences (cf. Fig. 2). Users who follow the *main explorer sequence* proceed from Opportunist over Scientist and Planner to Hacker. The ones following the *main socializer sequence* develop from Griefer over Networker and Politician to Friend. To address both sequences in the concept, we combined for every sequence position the two corresponding player types to one step. For example, step II contains the Scientist (position two in the main explorer sequence) and the Networker (position two in the main socializer sequence). Originally, the sequences have four player types. With respect to the dependency to the dimension of skill acquisition (which has five levels), we created step IV by extending the phases of the Planner and

[1]M. Z. Huber Kolpondinos, M. Glinz, Behind Points and Levels – The Influence of Gamification Algorithms on Requirements Prioritization (submitted for publication)

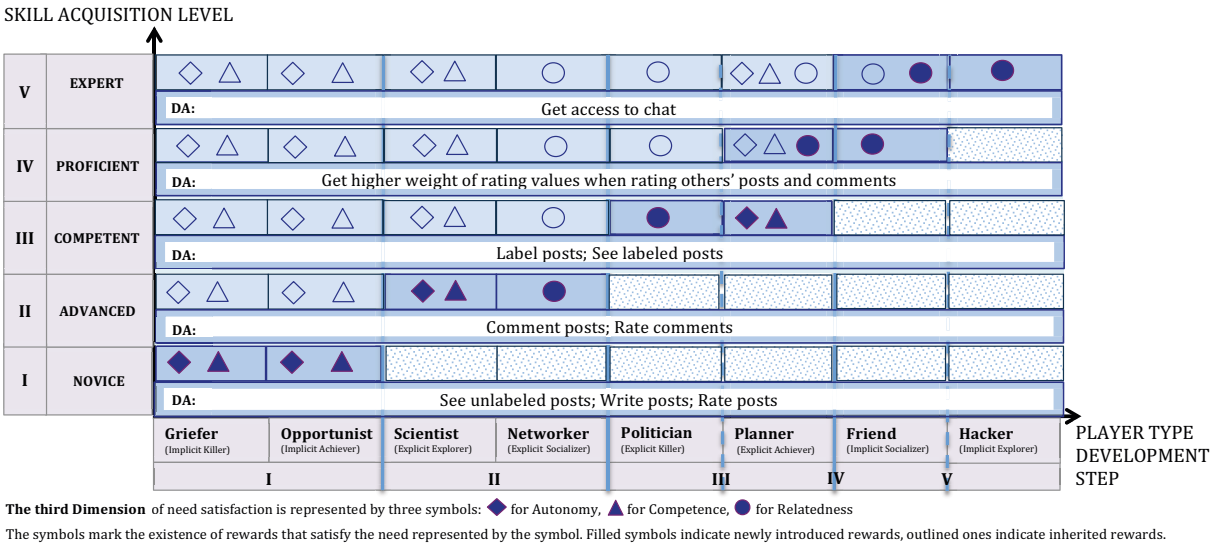

Fig. 3. Concept to motivate stakeholders outside organizational reach towards contributing to requirements elicitation by taking actions on a social media platform. The (potential) rewards are indicated by need satisfaction symbols and access to domain activities (DAs).

the Friend types. Our rationale for this decision was that a) all basic DAs are enabled in the previous levels, and b) these player types fit very well to the skill level of proficiency.

3) The Dimension of Need Satisfaction: Based on the hierarchical structure [17] and the relevance [15] of human needs, and with respect to the context of experiential learning we explicitly address autonomy and competence up to level three, and focus on relatedness on higher stages. To preserve the readability of Fig. 3, we represent the dimension of need satisfaction with symbols (diamond for autonomy, triangle for competence, circle for relatedness).

4) The Rewards: We introduced two different kinds of rewards in the concept: rewards that depend on game elements, e.g., status, access, and power [21], and rewards that depend on the domain activities.

Symbols indicate the existence of (potential) rewards that are mostly based on game elements, with respect to the three dimensions. For example, the circles in stage five (*level V / step V*) indicates rewards, which meet the criteria of skill acquisition level *Expert* and target the motivational triggers of the player types *Friend* and *Hacker*, while addressing the human need of *Relatedness*. Filled symbols indicate newly introduced (potential) rewards, while outlined symbols indicate reward possibilities that are inherited from previous levels.

Rewards that depend on DAs consider level-based access to activities that can be taken on the platform. For every level the activities are enabled for all player types, e.g., label posts on level III for player type steps one to five.

V. Example of Application

In this section, we present an example of how to design the rewards based on the concept. The example is supported by Fig. 3 and the concrete rewards used in the example are summarized in Table III.

A. Rewards on Different Stages of Stakeholder Development

For every stage, we first give an overview of the users' state of experience and goals, a general description of the reward criteria, and a concrete example. Due to space constraints we focus on rewards that are based on game elements.

1) Level I / Step I: Stakeholders access the platform for the first time. With their actions, they pursue the goal to explore the boundaries and basic rules of the domain while seeking to fulfill the need of autonomy and competence. *Reward Criteria:* On this stage the rewards are diverse, and address exclusiveness (Griefer). Further, they can be earned in different ways and to different times (Opportunist). *Example*: the diversity of rewards can be addressed by introducing one point category per DA. Further, exclusiveness, e.g., having received the most votes for a post, can be rewarded with a badge. The variety to achieve a reward can be addressed by granting access to a number of basic challenges, i.e., challenges that depend on the numbers of points per point categories. The urge for becoming better over time can be addressed by announcing the possibility to earn corresponding badges in the future, i.e., the next stage.

2) Level II / Step II: In this stage stakeholders are considered to be familiar with the basic aspects of the domain. With their actions they pursue the goal to cognitively process information and constantly update existing knowledge according to new situations while striving for fulfilling the needs of autonomy, competence, and relatedness. *Reward Criteria:* The rewards on this stage encourage exploring the domain with respect to the system (Scientist) and to the community (Networker). *Example*: getting more familiar with the system can be addressed with access to a number of advanced challenges and further be supported by announcing the possibility to earn corresponding badges in the next stage. Further, social

TABLE III
EXAMPLE REWARDS WITH RESPECT TO THE MOTIVATION CONCEPT

Stage	Player Type	Human Need	Example Reward
Step V Level V	Hacker	R	Get access to the expert circle
	Friend	R	Get the right to endorse others
Step IV Level IV	Friend	R	Get information about the authors' names for all posts
	Planner	R	Earn an award for having reached this level
Step III Level III	Planner	C	Earn a holistic badge
		A	Receive information about the distance to the next stage
	Politician	R	Get access to leaderboards
Step II Level II	Networker	R	Get information about ratings
	Scientist	C	Get information about future badges
		A	Get access to advanced challenges
Step I Level I	Opportunist	C	Receive information about future badges
		A	Get access to basic challenges
	Griefer	C	Earn a badge for being exclusive
		A	Earning points per activity

Human Needs: Autonomy (A); Competence (C); Relatedness (R)

influence can be increased by revealing the number of ratings for all posted needs.

3) Level III / Step III: Now, the stakeholders are more experienced. With their actions they focus on the goal to achieve success with respect to relatedness, competences, and autonomy. *Reward Criteria:* On this stage the rewards focus on power with respect to the urge to get more influence on others (Politician) and to beating the system (Planners). *Example*: the influence on others can be addressed by granting access to leaderboards. Further, the urge to beat the system can be considered by revealing the number of points that are needed to reach the next stage, and by introducing a holistic badge, i.e., one that can only be earned with respect to all DAs.

4) Level IV / Step IV: On this stage, the stakeholders know the relevant features of the domain. With their actions they focus on the goal to increase their influence on the system and their understanding of the community with respect to autonomy and relatedness. *Reward Criteria:* These rewards consider mastery over the system (Planner) and increased influence on the community (Friend). *Example*: mastery can be addressed with an award for reaching this stage and the influence in the community can be increased by revealing the authors' names for all posted needs.

5) Level V / Step V: Here, stakeholders have become experts with respect to the domain. Their actions follow the goal to get status in the community with respect to relatedness. *Reward Criteria:* Rewards in this stage focus on getting more influence in the community (Friend) and being honored (Hacker) by the system. *Example*: the right to endorse others and access to the circle of expert users can be granted.

VI. DISCUSSION

The concept presented in this paper contributes to answering the research question: *How can stakeholder outside organizational reach be motivated towards requirements elicitation?* Our concept addresses the challenge of not knowing these stakeholders, characterizes them with player types and keeps them motivated over time with rewards that are designed with respect to skill acquisition, player type development, and need satisfaction. The concept itself neither defines a number of rewards nor concrete rewards. Instead, it gives guidance of how to design rewards at a specific stage during the elicitation process.

We create an example that suggests fourteen rewards. Eight of them refer to the human needs of autonomy and competence, and six to relatedness. With respect to the focus on collaboration, this choice seams reasonable. However, other outcomes are possible for different purposes.

VII. THREATS TO VALIDITY

We are aware that this research is prone to threats to validity. In this section, we discuss the three threats that we consider most important. First, limiting the DAs for domain experts on lower levels could negatively affect the identification of relevant requirements. To better integrate experts, we suggest to complete our approach with traditional elicitation techniques, and to apply a questionnaire to place users in different levels when accessing the platform for the first time. Second, large numbers of posts could challenge their prioritization. We suggest to address this threat with collaborative filtering, e.g., [46] and user feedback analysis, e.g., [49]. On the other hand, a small number of initially identified stakeholders might demotivate early users due to a limited number of interactions. We suggest starting with a known number of stakeholders (within organizational reach), e.g., developers and clients, who can identify other stakeholders by applying snowballing. To make the process of stakeholder identification independent of these key stakeholders, we further propose to attract others with distributed ads that specifically address different player types. Moreover, we suggest that the rules per level depend on relative criteria, e.g., the number of active users, or posts. Third, gamification only works if people already have some inherent motivation in the product or service on which gamification is applied [50]. As being a stakeholder implies having some interest in the software system under consideration [51], we do not consider the lack of intrinsic motivation as a threat.

VIII. CONCLUSION AND FUTURE WORK

We presented a concept to motivate stakeholders outside organizational reach towards contributing to requirements elicitation by taking actions on a social media platform. The concept addresses the challenge of not knowing these stakeholders and considers that their experience and motivational factors change during the elicitation process. The presented research is preliminary and mostly theoretical. Nevertheless, we believe it will substantially contribute to the body of knowledge on motivating stakeholders outside organizational reach in RE due to its multidisciplinary foundation. However, more work is needed and we encourage other researchers to test and evolve the concept. In our future work, we will implement and evaluate it in a field case study.

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